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ABSTRACT

The 1973-74 Michigan Educational Assessment Program (MEAP) provided information on twenty-two separate measures of interest to educators. The program provides for measures of (1) word relationships, (2) mathematics, (3) reading and (4) attitudes (optional). In contrast to past programs, the mathematics and reading instruments are objective-referenced. Each test contains items that measure a set of minimal performance objectives. Committees of Michigan educators assisted in the development and review of both the objectives and the items. Because of the representativeness of the content domain, the tests, in general, can be judged to have good content validity. However, there are individual cases of unclear objectives or test items which need to be improved. The reading and mathematics test in their entirety are reliable tests for group decision-making. However, for certain objectives, the measured reliability of the five associated test items is such that caution should be used before making decisions about an individual's attainment of a particular objective. A majority of the objectives were mastered by between 50 and 90 percent of the students. In general, students who scored higher on the word relationships test did better on the objective-referenced tests. Last, the attitude surveys utilized in the assessment program appear to be reliable measures of two separate factors. (Author/RC)

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TECHNICAL REPORT

THE FIFTH REPORT OF THE 1973-74
MICHIGAN EDUCATIONAL ASSESSMENT PROGRAM

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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MICHIGAN DEPARTMENT OF EDUCATION
1975

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FOREWORD

This report is a review of some of the technical dimensions of the 1973-74 Michigan Educational Assessment Program. It is intended to convey to local school district administrators, counselors, teachers and other interested persons basic information which describes the data collected by the Program.

The Technical Report is the fifth report in a series of five prepared each year by the Michigan Educational Assessment Program. The other four reports are:

1. Objectives and Procedures
2. Individual Student and Classroom Reports
3. School and District Reports
4. Statewide Results

These reports are distributed routinely to Michigan school districts. Additional copies may be obtained by writing the Program in care of the Michigan Department of Education, Box 420, Lansing, Michigan 48902.

The major task of preparing this report was performed by Dr. William Mehrens, College of Education, Michigan State University with the assistance of staff of the Michigan Educational Assessment Program. Questions or comments related to this report should be directed to a staff member of the Michigan Educational Assessment Program.

John W. Porter
Superintendent
Public Instruction

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INTRODUCTION

The Michigan Educational Assessment Program (MEAP) is designed to assess educational needs in the basic skills of mathematics and reading. MEAP provides basic information about the educational attainments of fourth and seventh graders and the allocation of resources for all Michigan K-12 school districts. A complete description of the Michigan Educational Assessment Program may be found in the publication entitled Objectives and Procedures, which was the first report of the 1973-74 MEAP.[1]

The primary function of this report is to provide the technical information needed to describe the instruments and techniques used in the 1973-74 educational assessment program. The report is intended primarily for educators such as superintendents, directors of instruction, guidance and counseling specialists, and curriculum specialists. People with expertise in psychometrics, such as directors of research, research consultants, and evaluation specialists may wish to obtain more detailed psychometric information which is available in the report entitled A Report on the Technical Characteristics of the Reading and Mathematics Instruments of the 1973-74 Michigan Educational Assessment Program. This report is available in very limited quantities and may be obtained by writing the Supervisor, Michigan Educational Assessment Program, Research, Evaluation, and Assessment Services, Michigan Department of Education, Box 420, Lansing, Michigan 48902.

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[1]Michigan Department of Education, Objectives and Procedures: The 1973-74 Michigan Educational Assessment Program, (Lansing, Michigan: Michigan Department of Education, August, 1973), passim.

SECTION I

THE 1973-74 MICHIGAN EDUCATIONAL ASSESSMENT PROGRAM

Scope of the Program

The 1973-74 Michigan Educational Assessment Program provided information on twenty-two separate measures related to students and schools. A list of these measures is presented in TABLE 1. They can be classified into seven major categories: human resources; district financial resources; percent minority; dropout rate; student achievement; size measures; and attitudes (optional). A complete definition of each measure is given in APPENDIX A.

In September and October, 1973, all fourth and seventh grade students receiving regular classroom instruction in the content areas of reading and mathematics in the Michigan public schools participated in the educational assessment program. TABLE 2 shows the number of districts and students from or about which information was obtained for the 1973-74 assessment program.[2]

The 1973-74 program provided for tests of (1) word relationships, (2) mathematics, (3) reading and (4) attitudes (optional). In contrast to past educational assessment programs, the mathematics and reading instruments were objective-referenced.

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[2]The numbers reported in TABLE 2 may vary from the numbers of students and districts displayed in other reports of the assessment program. These differences arise because data for some schools and districts were not available for every variable.

TABLE I

A LIST OF THE TWENTY-TWO MEASURES REPORTED
AT THE DISTRICT, SCHOOL, OR CLASSROOM LEVELS

MEASURES	DISTRICT	SCHOOL	CLASSROOM
A. Human Resources (1972-73 data)			
(1) Professional Instructional Staff per 1,000 Pupils	X	X	
(2) Teachers per 1,000 Pupils	X	X	
(3) Average Years Teaching Experience	X	X	
(4) Percent of Teachers with Master's Degree or Above	X	X	
(5) Average Contracted Salary per Teacher	X	X	
B. District Financial Resources (1971-72 data)			
(6) State Equalized Valuation per Resident Member	X		
(7) Local Revenue per Pupil	X		
(8) State School Aid per Pupil	X		
(9) K-12 Instructional Expense per Pupil	X		
(10) Elementary Instructional Expense per Pupil	X		
(11) Total Current Operating Expense per Pupil	X		
(12) Total Operating Millage	X		
C. Percent Minority (1972-73 data)			
(13) Percent of Racial-Ethnic Minority Students	X	X	
D. Dropout Rate (1971-72 data)			
(14) School Dropout Rate	X		
E. Student Achievement (1973-74 data, provided separately for grades 4 and 7)			
(15) Word Relationships	X	X	X
(16) Reading	X	X	X
(17) Mathematics	X	X	X
F. Size Measures (1972-73 data)			
(18) Grade 4 Membership	X	X	
(19) Grade 7 Membership	X	X	
(20) Total Membership	X	X	
G. Attitudes (Optional, 1973-74 data)			
(21) Attitude toward Self	X	X	X
(22) Attitude toward School	X	X	X

TABLE 2

NUMBER OF DISTRICTS AND STUDENTS PARTICIPATING
IN THE 1973-74 ASSESSMENT PROGRAM

Grade	Number of Districts	Number of Students
4	597	159647
7	597	167873

Assessment Tests Utilized

Mathematics and Reading Instruments

The Development of Performance Objectives. To accomplish specification of the objectives, Grade Level Commissions were established in November, 1971. These Commissions were composed of teachers, curriculum specialists, school administrators, and citizens who were nominated for membership by various professional and civic organizations. These groups were given the responsibility for reviewing performance objectives being developed by Department of Education specialists and teachers from across Michigan. The minimal performance objectives in mathematics and reading tested in the 1973-74 assessment were selected from those reviewed by the Commissions and subsequently adopted by the State Board of Education.

The minimal performance objectives represent a set of minimal expectancies applicable to all fourth and seventh grade students in the state. They do not outline complete curricula in any academic area but, instead, articulate certain skills thought to be of high importance for each student. Attainment of these objectives is believed to be necessary

for successful progress from grade to grade. A local district would, naturally, have many additional academic objectives which it would consider desirable for students to attain.

The Development of Objective-Referenced Tests. For four years, beginning in 1969-1970, MEAP used standardized norm-referenced tests which simply produced rankings of students. However, with the adoption of The Common Goals of Michigan Education and objectives delineating the academic goals, tests specifically designed to measure attainment of these objectives were preferred. Objective-referenced tests were capable of revealing specifically which skills students had attained and were, thus, more useful for instructional planning than those which had produced rankings only.

In 1972, a project was begun to write and validate test items to measure the minimal mathematics and reading objectives. Under the direction of the Michigan Department of Education, selected teachers, curriculum specialists, and administrators from five school districts (Alma, St. Louis, Jackson, Pontiac, and Waterford) wrote the items. The test items were edited by the Department and a technical support contractor, California Test Bureau/McGraw-Hill. The items were tried out in the five districts, as well as in the Detroit Public Schools.[3] Revisions were made based on teachers' comments and reviews by subject-matter specialists. The final instruments, produced by the technical support contractor following specifications approved by the Department, include measurements of twenty-

[3]It should be pointed out that the districts involved with the development and pilot testing of the items had considerable minority representation and attempts were made to eliminate any cultural bias in the items.

three performance objectives in reading and thirty-five performance objectives in mathematics at the fourth grade level and twenty-three reading and forty-five mathematics objectives at the seventh grade level.

APPENDIX B contains a list of the objectives which are measured by the 1973-74 tests. Not all of the minimal reading and mathematics objectives which have been developed are currently included in the assessment tests. It was not possible to measure all of them given the limitations of available testing time, staff and money.

Word Relationships Test

All students took the word relationships test, a verbal analogy test of 45 items for grade four and 38 items for grade seven. The tests were timed tests: 20 minutes for grade four and 15 minutes for grade seven. The fourth grade test was a revised edition of the nationally standardized School and College Ability Tests (SCAT) Verbal Test, Level 4, Form B; the seventh grade test was based on the SCAT Test, Level 3, Form B. The tests were originally standardized for Michigan on the fourth and seventh grade populations taking the test in January of 1970. Educational Testing Service, at the request of the MDE, changed the tests to their present version by reducing the number of items and making some item substitutions with the intent of slightly lowering the level of item difficulty.

The word relationships portion of the educational assessment battery measures knowledge of the meanings of words and understanding of relationships among words and concepts. The word relationships score is not considered to be very sensitive to instruction and may be considered for purposes of this program as a test of verbal aptitude. The word relationships instruments used in 1973-74 are identical to those used in the 1972-73 program.

Attitude Test

Approximately half of the students in grades four and seven took an optional 30 item Pupil Attitude Questionnaire which was developed jointly by the Michigan Department of Education and Educational Testing Service, Princeton, New Jersey. The Questionnaire was completed anonymously by the students in the districts which selected this option. The resultant data were not reported for individual students but were reported at the classroom, school, and district levels.

Each instrument contained fifteen statements about the student and fifteen statements about school. The student responded to each statement by selecting one of three choices: "True," "I'm not sure," or "False." The fourth and seventh grade instruments are identical with the exception of a single item. TABLE 3 gives several examples of the statements grouped by the scale to which they belong.

Eleven of the fifteen statements about school are worded positively--i.e., the desired response, the one expressing a positive attitude about school, is "True." Only four statements (e.g., #29, "My school work is not very interesting.") have "False" as the desired response.

The exact opposite is true of that part of the questionnaire dealing with self. On eleven of the fifteen questions which the student is to answer about himself, the desired response is "False" (e.g., #23, "I feel bad most of the time."). Because the test intermixes school and self statements, there is little problem of a positional response set being formed. However, a more even balance of responses--positive and negative--for each attitude might have produced slightly different responses.

TABLE 3

EXAMPLES FROM THE PUPIL ATTITUDE QUESTIONNAIRE

Statements About School	Statements About Self
1. Most of the things I learn in school are interesting.	2. I worry a lot about school.
3. I would rather go to school than stay home.	4. I usually cannot work as fast as others.
5. School helps me to be a better person.	25. I am a good student.

SECTION II

TECHNICAL CHARACTERISTICS OF THE TESTS

To determine the technical characteristics of the word relationships Test and the objective referenced reading and math tests, a sample of 5000 students from each grade level was drawn. The design used to select the sample of fourth and seventh grade students from the complete data file(s) ensured that the sample was spread over the classrooms, schools, and school districts of the population. These data were used to generate the necessary statistical information to describe the technical characteristics of the tests.

Word Relationships Test

The scores on the word relationships test were reported to local school districts in "equated form"--that is, they were standardized scores based on the January, 1970, score scale. The original 1970 standard scores were a linear transformation of the raw scores (number of questions answered correctly) such that the mean of the standard scores was 50 and the standard deviation 10. (These are commonly called linear T scores.) Since the 1973-74 standard scores were equated to the 1970 score scale, comparisons can be made between the fall, 1973, and winter, 1970, test results.

However, for the first four years of the assessment program, the tests were administered in January whereas in the fifth year (1973-74), the testing date was moved to September. This change led to a decrease in the raw score means for the state and for most local school districts. For the entire state, this decrease was slightly less than three standard score points but local school districts may experience more or less than

that amount depending on the relative abilities of the students from the two years.

Pupil norms for the 1973-74 tests were unavailable at the time of testing due to the fact that not all schools were able to complete the tests in the specified time frame. Therefore, the norms provided with the individual student reports were those of January, 1973. Revised norms were calculated from the sample of 5000 cases, previously mentioned, and are included in APPENDIX C of this report.

Separate reliability data were not gathered for the word relationships test in the 1973-74 school year. However, for the same test given in 1972-73, the internal consistency reliability for grade four was .90, and the reliability for grade seven was .86.[4] Internal consistency reliability estimates indicate the extent to which the items that make up the test measure the same thing. The values obtained for the word relationship tests compare favorably with reliability coefficients on other standardized aptitude tests of similar length.

Mathematics and Reading Tests

Test Length

As discussed earlier, the Michigan State Board of Education adopted objective-referenced tests (ORT) pursuant to the decision to measure minimum level performance of the state's fourth and seventh grade student population. To assure accurate measurement of an individual student's attainment of these objectives, five test items were constructed for each objective. If a student correctly answered at least four items, he was classified as attaining the objective.

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[4]These coefficients were calculated by Kuder-Richardson Formula #20.

The number of items has a general effect on the accuracy of a given score. That is to say, if on a sample of items a student answered four out of five correctly and, therefore, was classified as having passed the objective, a probability exists, associated with the number of items, that he does not know 80% of all possible items that measure the objective and, therefore, has been misclassified. A different misclassification probability exists for the student who answered only two or three out of five correctly but, in fact, does know 80% of all possible items that measure the objective. Both kinds of misclassifications are possible because the student is being tested on only a few of the items from the domain of all items which could be written to measure a particular objective.

Increasing the number of items on a test will reduce the percent of students who are likely to be misclassified. With a greater number of items, a teacher can be more confident that the obtained score accurately reflects or approximates the student's true level of learning for that objective. Five items were used to measure each performance objective because it was desirable to measure as many objectives as possible within a limited testing time and, yet, to have a sufficient number of measures per objective, to minimize the effect of guessing, and to facilitate the manner of reporting, interpretation and utilization of the results. This decision, of course, represents a compromise among these considerations.

As a final point, the reading and mathematics tests were untimed tests. Students were allowed to use as much time as seemed (to the test administrator) to be reasonable. It, thus, became a self-paced assessment of these two academic skills.

Passing Score

For the 1973-74 assessment tests, the passing level for a student was set at four out of five items. A student passed an objective if four or five items were correctly answered and failed if three or fewer items were correctly answered. The four-out-of-five decision principle for passing an objective was reached on the basis of the low probability of passing the objective by guessing. With this criterion for attainment of an objective and assuming the student who does not meet the objective guesses randomly on all five questions, the probability of his being improperly classified as "passing" the objective is between one and two percent.

When using four out of five items for a criterion, this figure may be considered a lower-limit probability. In practice, one finds that many items are imperfect indicators of the objective being measured. Students, therefore, may be able to eliminate one, two, or three of the foils as erroneous choices thereby increasing the probability of passing the objective.

Content Validity

Content validity is related to how adequately the content of the test samples the domain about which inferences are to be made. The domain typically is more narrowly defined in objective-referenced testing than in traditional norm referenced achievement tests. There are really three levels of questions which one could ask concerning the content validity of the MEAP tests: 1) Do the performance objectives published by the MDE really constitute worthwhile objectives one should be striving to attain? (That is, is there a consensus that these are important minimal objectives?)

2) Do the objectives assessed in the MEAP tests adequately represent the entire set of important objectives and, if not, what is the entire set? and 3) Do the items in the tests actually measure the objectives with which they are identified?

Consensus? The answer to the first question is generally yes. Considerable care went into the specification of objectives which were intended to constitute the minimal objectives in reading and mathematics at the ends of grades 3 and 6. Hundreds of Michigan educators were involved in writing the objectives including classroom teachers, curriculum specialists, and administrators. However, it must be acknowledged that no attempt was made to have all Michigan educators vote on the acceptability of the objectives. It also must be recognized that the appropriateness of some objectives may be questioned as additional data are accumulated about students' skills and abilities.

Adequate Representation? The objectives assessed in the MEAP tests did not adequately represent the total set of objectives toward which a school should strive nor even the total set of objectives in the areas of mathematics and reading. Indeed, they were not designed to do this.

Approximately half of the minimal reading objectives were measured at the fourth and seventh grade levels. Specifically, at grade four, twenty-seven out of fifty-one objectives were measured (two subsets of three objectives each were combined resulting in twenty-three reported scores). At the seventh grade, twenty-five objectives were measured out of a total of fifty (three objectives were combined and twenty-three scores reported).

In mathematics at grade four, thirty-five objectives were measured while at grade seven, forty-five were measured. These objectives were

taken from the larger set of five hundred forty-two objectives for kindergarten through grade nine. They represent a set of highest priority objectives for testing purposes designated by the Michigan Council of Teachers of Mathematics.

The tested objectives were not selected on a random basis from the total set of objectives for either reading or mathematics. It, therefore, would not be proper to attempt to predict a student's attainment of the total set of objectives from his performance on the 1973-74 MEAP tests.

Relationship between Objectives and Items. The answer to the third question regarding the relationship between the test items and the objectives they measure is especially important for objective-referenced tests. Performance objectives, when well written, are clear statements of the skill to be attained, but even then the act of constructing the matching test item tends to add further definition to an objective. The question, therefore, becomes divided into three subdivisions:

1) Are the objectives specific?
2) Do the items match the objectives?
3) What are the effects of the stimulus materials used?

Each of these will be considered separately.

Specificity of Objectives. As mentioned, for a good match between test items and objectives, the objective should be as specific as possible. The specificity of an objective is the factor which restricts an item writer's ability to alter the original intent of the objective. In general, the more vague an objective is, then the more latitude the item writer has in actually defining the tasks required by the objective.

The mathematics objectives upon which the assessment tests were based seem to be more specific than the reading objectives. The reading objectives, by contrast, tend to be more open to interpretation particularly

since so many of them depend upon the provision of a reading selection at the third (or sixth) grade level.

Match of Objectives and Items. In theory, the test items should perfectly measure the skills required by the objective. An objective devoted to the addition of two digit numbers in vertical order should only be tested by items of two digits in that order.

For the most part, the assessment test items do match the objectives. However, some exceptions do exist particularly where the given conditions of the objective could not be perfectly matched with the type of assessment tests being developed. For example, some mathematics objectives specified the use of manipulative objectives. In testing these objectives, pictures of objects were used rather than providing the specified objects.

Effects of the Stimulus Materials. It should be recognized that limited resources necessitated the use of multiple choice, paper and pencil tests suitable for administration to groups of students. It is conceivable that there are students who would show higher attainment rates if the tests were administered under other conditions.

In addition, one must consider the effect on the results of the reading material used in the tests particularly on the mathematics tests. It is probable that some students simply could not read the test questions or instructions.

Unfortunately, there is no expedient way to quantify the three factors cited in the above paragraphs. Such judgments are largely subjective and should be made by curriculum specialists and psychometricians who review the test results. The Department of Education has taken the necessary steps to complete such analyses.

Another dimension of test validity is provided by the concept of

criterion-related validity. Criterion-related validity refers to the phenomenon in which a test of interest (the MEAP tests) is related to some specific external measure (criterion). The external measure may be, but does not have to be, another test. If it is another test, it should be a test which measures the same type of phenomenon--in this case, an achievement test in reading or mathematics.

In investigating the criterion-related validity of the MEAP tests, no other achievement data were readily available to serve as the criterion. However, data from the word relationships test were accessible. This test is a norm-referenced, standardized test of verbal ability and is highly related to academic achievement. These data were, therefore, related to the achievement test results to determine whether or not the MEAP test data were related to the word relationships data as one would expect.

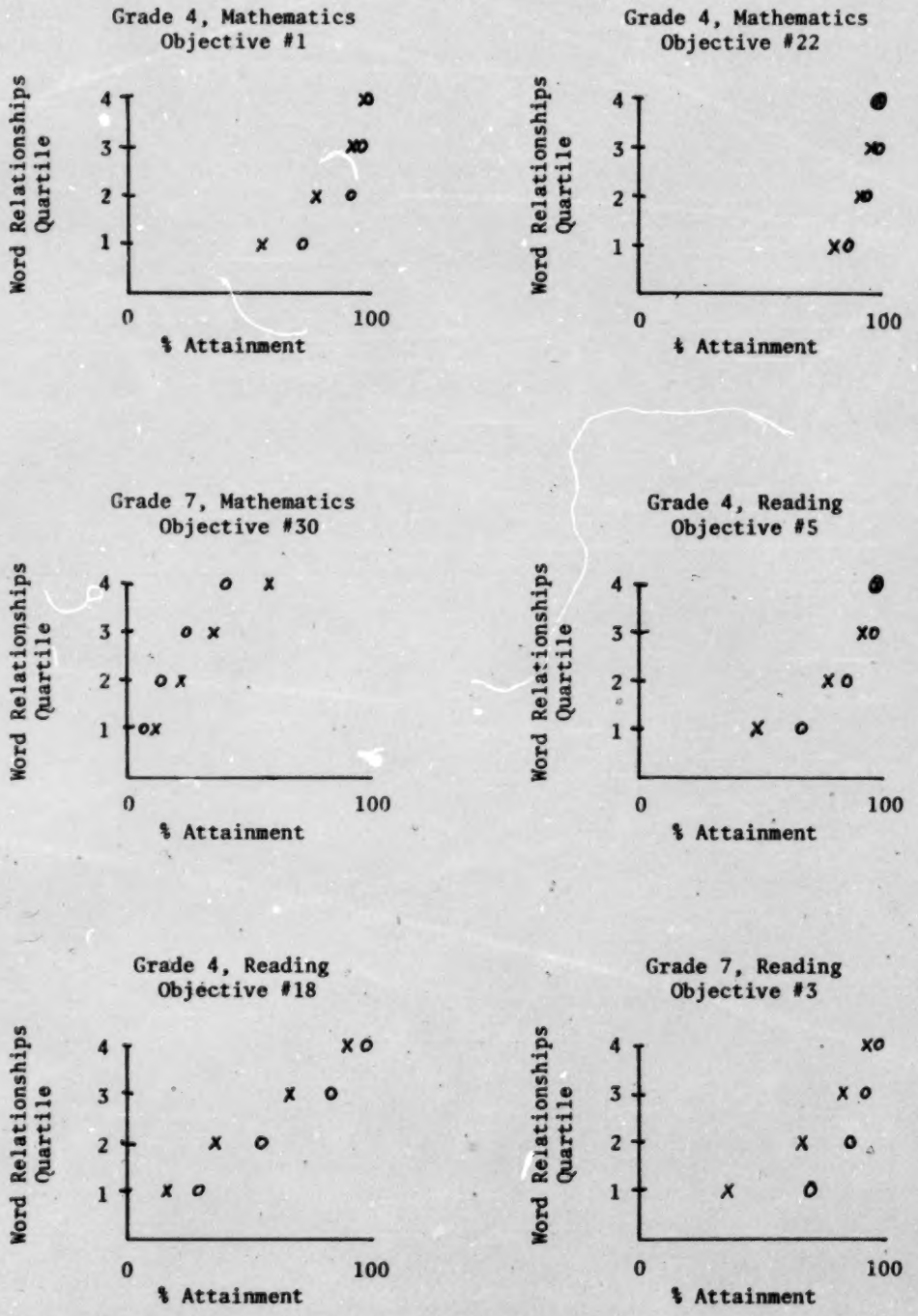
To investigate this question, the student scores in the previously mentioned sample of 5000 students were subdivided into quartiles on the word relationships test. For each of these ability groups, the mean number of test items correctly answered for each objective was calculated. In every case, the mean score for each successive performance group was higher than that of the preceding group.

FIGURE 1 displays the differential attainment rates of boys and girls for six of the objectives in the 1973-74 assessment. In every case, the curve illustrates the phenomenon--students with higher ability tended to attain more of the test questions and, hence, more of the objectives.

The implication from these data is that the educational assessment test results will rank students according to their verbal ability. Rankings resulting from other achievement tests are likely to be similar to those obtained from the MEAP data. Those who are interested in pursuing the topic

FIGURE 1

ATTAINMENT RATES ON SELECTED OBJECTIVES FOR BOYS AND GIRLS DIVIDED BY QUARTILE ON WORD RELATIONSHIPS SCORES[a]



[a]x= boys and o= girls.

in greater detail may refer to A Report on the Technical Characteristics of the Reading and Mathematics Instruments of the 1973-74 Michigan Educational Assessment Program.

State Results

FIGURES 2 and 3 show the statewide attainment ratings for each objective at the fourth and seventh grade, respectively. These displays are simply vertical bar graphs in which the percentage of students attaining an objective (i.e., answering four out of five items correctly) is shown for each objective. While the percentage of attainment can theoretically be any value from 0-100, it must be recognized that the MEAP was attempting to measure minimal objectives for which attainment rates above 85% would be desirable.

There are several explanations of why the attainment rates were not above 85%. These have been shared with local school superintendents in various publications and are worth repeating here.

I. Students do not have the skill described by the objective.

   A. Students cannot learn the skills.

   B. Students have not been taught the skills.

      1. Skills are taught later.

      2. Skills are not taught at all.

      3. Classroom materials currently in use do not include these skills.

   C. Instruction in the skills is ineffective.

      1. New teaching strategies are needed.

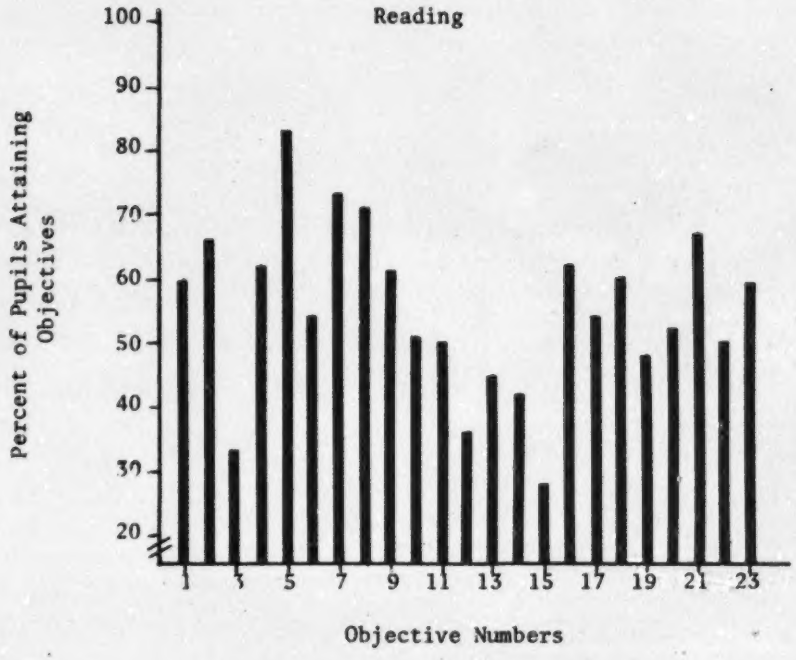
      2. Available instructional materials are inadequate.

      3. Staff skills need further development.

      4. Resources available are inadequate.

FIGURE 2

STATEWIDE ASSESSMENT RESULTS, GRADE FOUR



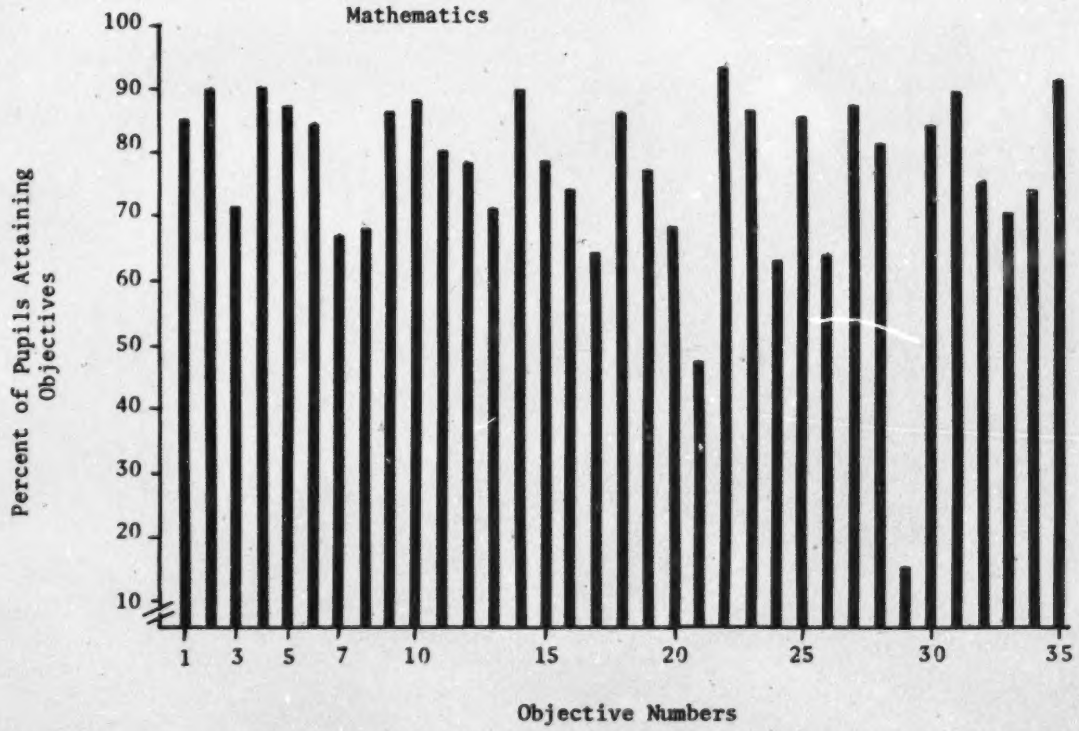
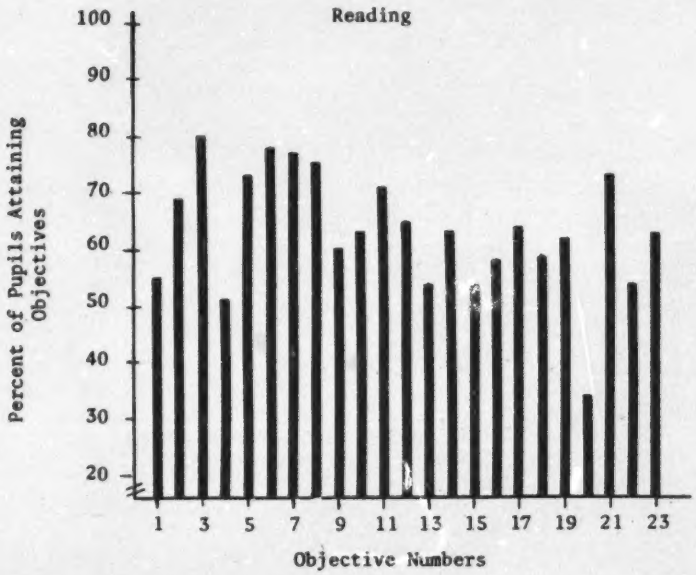
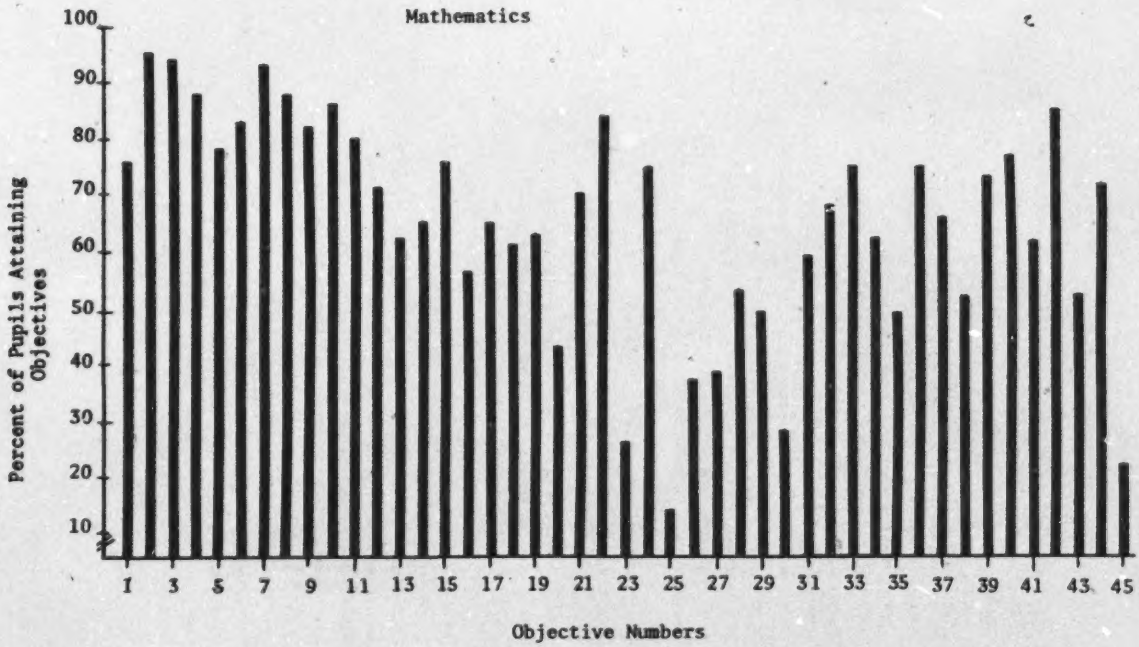


FIGURE 3

STATEWIDE ASSESSMENT RESULTS, GRADE SEVEN





II. The objective is inappropriate for the fourth (or seventh) grade students.

A. The objective should not be taught (philosophic disagreement).

B. The objective is not minimal - cannot be attained by all students at this stage of development.

C. The objective describes a skill which presently known teaching practices are unable to impart.

III. The test items are not adequate measures of the objective.

A. The test items may require an inappropriate level of mastery.

B. The reading level of the test items may be too difficult for some students.

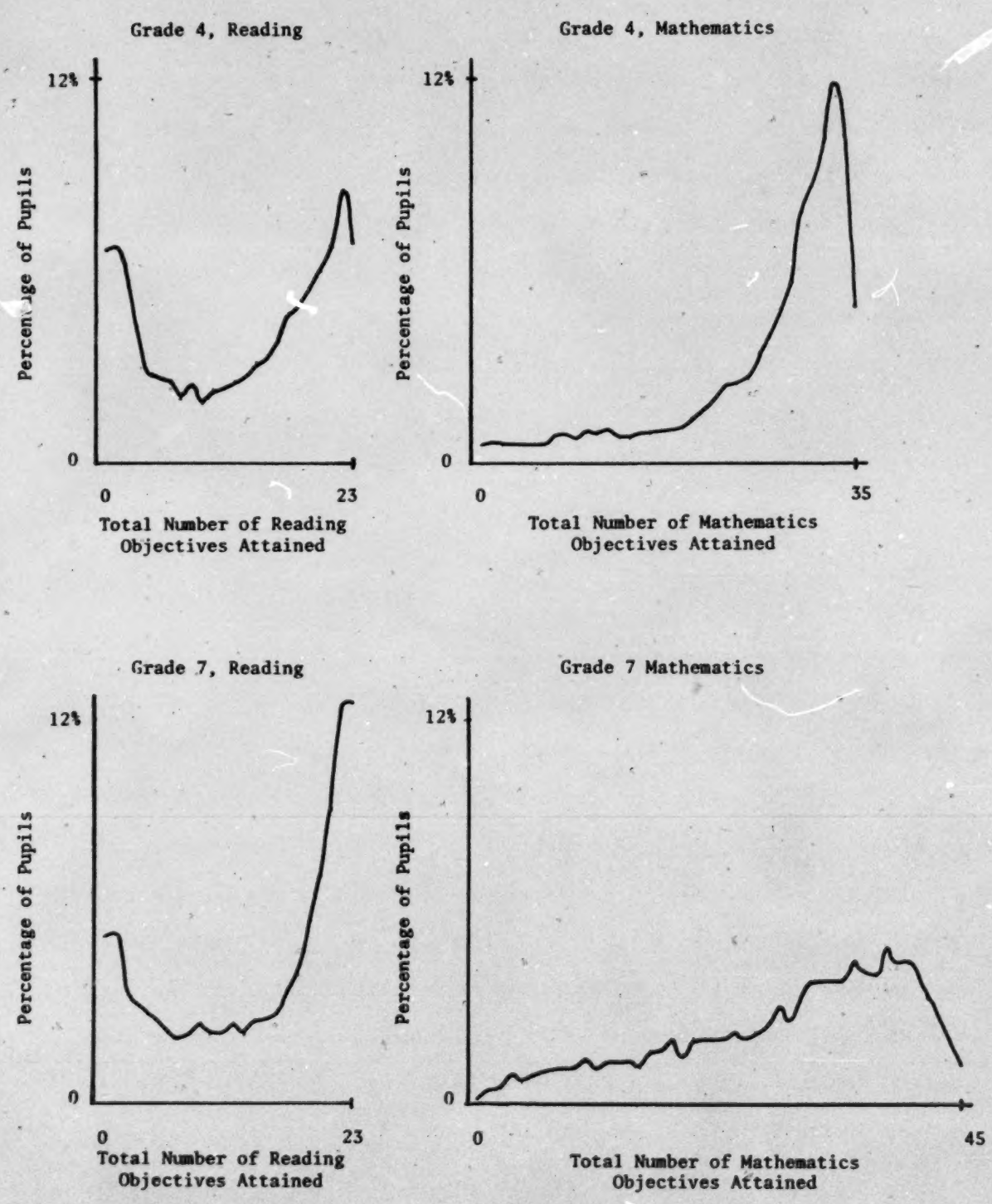
C. The mechanical aspects of the test - i.e., separate answer sheets, length of test, use of optical scan answer sheets, etc., may have confused students.

Unfortunately, all of these reasons can apply to one degree or another, and, furthermore, there is no way to make such decisions completely objective. Decisions on these questions can only be reached as local educators, state curriculum specialists, and psychometricians review the tests and share their conclusions with the Department of Education.

An alternate manner of viewing the statewide test results is presented in FIGURE 4. For purposes of this graph, the total number of objectives attained by each student was considered to be a "total score." The "total score" for all students was then separately plotted for each grade level and subject area. The graph for fourth grade reading thus shows the percentage of students who attained no objectives (about 6%), one objective, two objectives, and so forth up to the total number of objectives measured (in this case, 23).

FIGURE 4

FREQUENCY DISTRIBUTION OF PUPIL "TOTAL SCORES"
BY GRADE AND SUBJECT



As can be seen, the graphs for reading are sharply different from those for mathematics, the former being "U" shaped while the latter appears to be a skewed, bell-shaped distribution. Theoretically with a test of minimal objectives, almost all of the students should attain all of the objectives leading to a graph with a single vertical peak on the right side. In practice this did not happen for a number of reasons already discussed.

In attempting to understand better the properties of this score, one can calculate the correlation between attainment of an individual objective and the score value as shown in FIGURE 5.

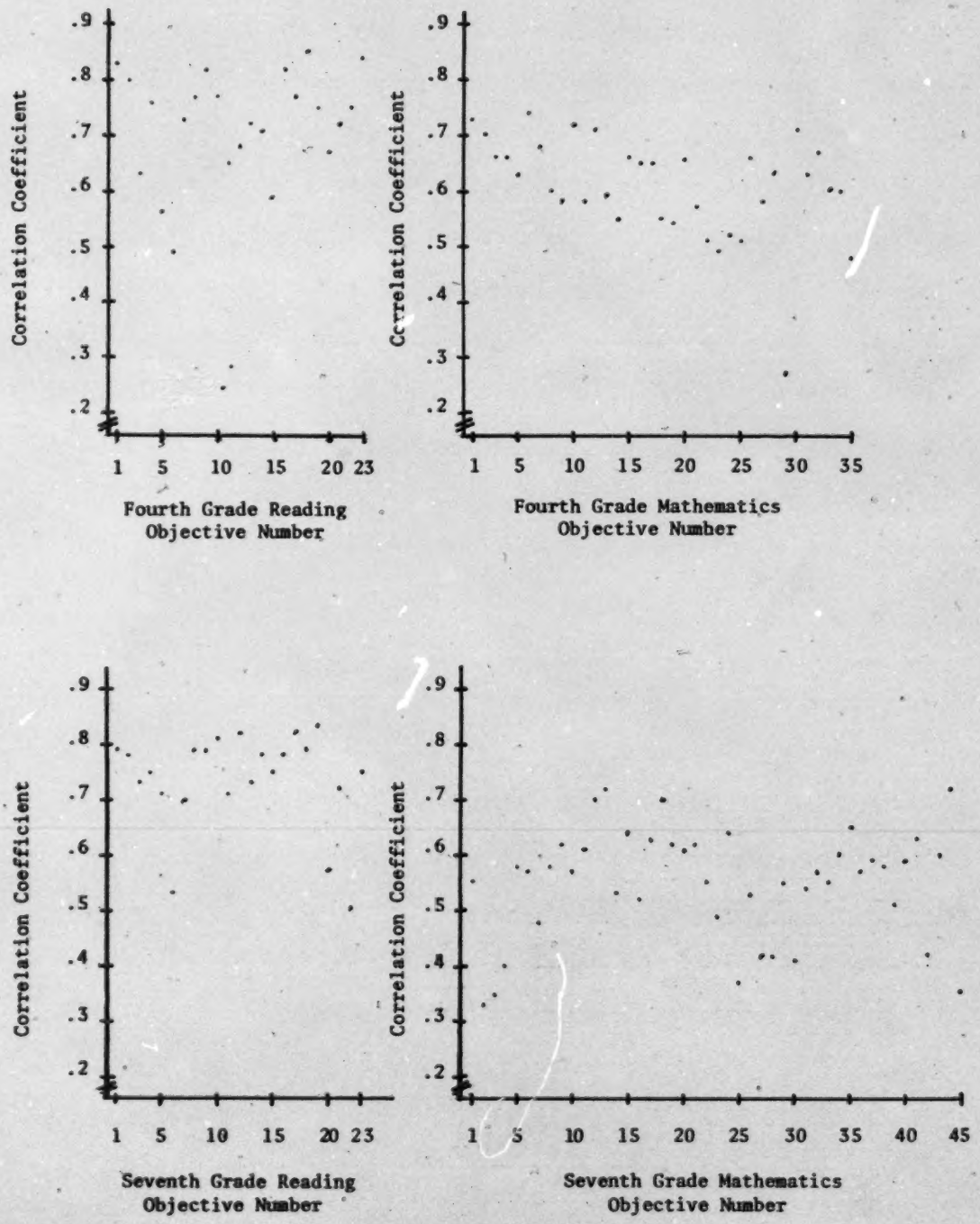
In FIGURE 5, the mathematics correlations appear to be generally lower than those of reading. This would indicate that the reading objectives are, in a sense, redundant. Despite this redundancy, it probably would not be advisable to shorten the test because measurement of the separate objectives is important for instructional reasons if not for good measurement.

In the case of the mathematics test, the correlations indicate that there is more unique information attributable to the individual objectives. Each objective appears to be measuring a separate skill or concept.

Each curve illustrated in FIGURE 4 results from plotting the sum of the binomial variable "pass-fail" for a sample of students on the total number of objectives for one subject and grade level. Theoretically, the curves will approximate a normal, bell-shaped curve when attainment of one objective is relatively independent of the attainment of another. Normal, bell-shaped curves are not expected in tests of this type because of the correlations between the various objectives. As the correlational values increase, the test variance increases and the curve flattens out.

FIGURE 5

CORRELATION OF EACH OBJECTIVE WITH THE TOTAL NUMBER OF OBJECTIVES ATTAINED



When the correlations are sufficiently high, the curve becomes bimodal (or u-shaped) as in the graphs for reading in FIGURE 4.

Simply stated, this means that when a student attains a particular reading objective, he is very likely to attain another and another and consequently have a high total reading score. For mathematics, the skills tested are less related (e.g., addition and reading a thermometer); hence, attainment of a particular objective is less apt to mean a second or third will be attained.

As a last point, if one considers the total number of objectives attained as a single score (as previously described), it is possible to compute a KR-20 reliability value which would reflect the homogeneity of the total score. The results of these calculations are shown in TABLE 4 and are, obviously, very high.

TABLE 4

RELIABILITY ESTIMATES FOR THE TOTAL MATHEMATICS AND READING TESTS

Fourth Grade	
Mathematics	0.95
Reading	0.96
Seventh Grade	
Mathematics	0.95
Reading	0.96

Reliability

Reliability of achievement tests is generally of three types--homogeneity (the extent to which all items in a test measure the same thing), item sampling (the extent to which two or more sets of items drawn from the same universe of items are correlated), and temporal stability (the correlation between sets of scores derived from two administrations of the same test over a period of time). For the Michigan Educational Assessment Program tests, the homogeneity method of describing reliability was used.

Estimates of reliability by the homogeneity method generally produce conservative estimates of the reliability of the test. An advantage is that these estimates may be gathered from data taken from a single administration of the test and calculated by the simple Kuder-Richardson formulas.

On the assessment instruments, each objective was measured by five items which was considered to be a "test." Reliability figures were, therefore, calculated for each objective. The resultant coefficients are displayed in TABLES 5, 6, 7, and 8.

As can be seen from TABLES 5-8, the reliability coefficients are generally lower than one typically obtains for longer achievement tests. This is a reflection of the fact that test length is related to test reliability coefficients. Objective-referenced tests may also seem to be less reliable than norm-referenced tests since the populations may lack variability in the skill being measured.

The coefficients of TABLES 5-8 are, for the most part, respectably high (above 0.70), but a few are low enough to be of concern (e.g., objective 29 at grade four). The reader should be cautious in interpreting these coefficients because low values may be an artifact of extreme item difficulties or of skewed distributions.

TABLE 5

FOURTH GRADE MATHEMATICS TEST
KR-20 RELIABILITY DATA

Objective	Reliability Coefficient	Objective	Reliability Coefficient
1 AR-I-A-6	.88	19 AR-I-B-84	.72
2 AR-I-A-8	.88	20 AR-I-B-85	.88
3 AR-I-A-16	.90	21 AR-I-B-86	.72
4 AR-I-A-24	.84	22 AR-II-A-10	.71
5 AR-I-A-40	.90	23 AR-II-B-6	.58
6 AR-I-B-7	.86	24 AR-II-B-9	.91
7 AR-I-B-32	.93	25 AR-II-B-11	.65
8 AR-I-B-40	.78	26 AR-II-B-13	.85
9 AR-I-B-43	.81	27 AR-II-B-15	.75
10 AR-I-B-44	.88	28 AR-II-B-16	.80
11 AR-I-B-45	.77	29 AR-II-D-1	.43
12 AR-I-B-64	.79	30 M-I-A-5	.83
13 AR-I-B-65	.72	31 M-II-A-6	.76
14 AR-I-B-67	.67	32 M-II-B-3	.65
15 AR-I-B-70	.79	33 M-II-C-1	.64
16 AR-I-B-79	.62	34 G-I-A-2	.75
17 AR-I-B-81	.82	35 AL-1	.59
18 AR-I-B-82	.63		

TABLE 6

FOURTH GRADE READING TEST
KR-20 RELIABILITY DATA

Objective		Reliability Coefficient	Objective		Reliability Coefficient
1	2.1	.73	13	8.4	.66
2	2.2	.86	14	9.3	.66
3	3.1	.58	15	10.2	.56
4	3.2	.83	16	10.3	.75
5	4.1	.73	17	10.6	.71
6	4.4	.69	18	11.1	.77
7	5.1	.84	19	11.2	.65
8	5.2	.88	20	13.1	.64
9	6.1-6.3	.73	21	13.2	.75
10	7.1	.65	22	14.1-14.3	.64
11	7.2	.51	23	--	.76
12	7.3	.62			

TABLE 7

SEVENTH GRADE MATHEMATICS TEST
KR-20 RELIABILITY DATA

	Objective	Reliability Coefficient		Objective	Reliability Coefficient
1	AR-I-B-87	.73	24	AR-IV-B-3	.71
2	AR-I-B-89	.81	25	AR-IV-B-6	.47
3	AR-II-A-22	.55	26	AR-IV-B-9	.63
4	AR-II-A-26	.64	27	AR-VI-15	.45
5	AR-II-B-20	.77	28	M-I-A-10	.55
6	AR-II-C-6	.80	29	M-I-B-8	.76
7	AR-II-C-11	.79	30	M-I-C-7	.86
8	AR-II-C-13	.73	31	M-II-A-10	.65
9	AR-II-C-15	.77	32	M-II-A-11	.74
10	AR-II-D-5	.68	33	M-II-B-7	.62
11	AR-II-D-7	.90	34	M-II-B-8	.70
12	AR-II-D-9	.79	35	M-II-B-9	.70
13	AR-II-D-15	.82	36	M-II-C-3	.62
14	AR-II-A-1	.90	37	G-I-A-4	.75
15	AR-II-A-18	.90	38	G-I-B-3	.66
16	AR-III-A-19	.83	39	G-I-B-5	.88
17	AR-III-B-4	.91	40	AL-4	.68
18	AR-III-B-7	.73	41	AL-5	.75
19	AR-III-C-4	.77	42	AL-7	.66
20	AR-III-C-6	.83	43	AL-2	.77
21	AR-III-D-4	.88	44	AL-10	.80
22	AR-IV-A-3	.89	45	P-9	.63
23	AR-IV-A-7	.85			

TABLE 8

SEVENTH GRADE READING TEST
KR-20 RELIABILITY DATA

Objective		Reliability Coefficient	Objective		Reliability Coefficient
1	18.1	.78	13	24.4	.69
2	18.2	.80	14	25.3	.71
3	19.1	.84	15	26.3	.65
4	19.2	.66	16	27.2	.70
5	20.1	.78	17	28.1	.71
6	21.1	.73	18	29.1	.68
7	22.1	.83	19	29.5	.72
8	22.2	.88	20	30.2	.62
9	23.1-23.3	.69	21	31.1	.73
10	24.1	.71	22	31.2	.58
11	24.2	.64	23	32.1	.72
12	24.3	.76			

The Pupil Attitude Questionnaire

The Pupil Attitude Questionnaires utilized in the 1973-74 Michigan Educational Assessment Program were briefly described earlier in this report. Only the technical characteristics of test reliability and factor groupings will be presented in this section.

Reliability

The reliability of attitude surveys can be determined by the same methods mentioned previously in regard to the achievement tests. The homogeneity method is used in this case, and, as before, it indicates the degree to which the survey items are measuring the same phenomenon consistently. The reliability estimate in this case was calculated with the widely-used "coefficient alpha" formula which is related to Kuder-Richardson Formula 20.

The resultant values for the reliability estimates are shown in TABLE 9. The attitude toward self measure has a slightly lower reliability, but all of the estimates are reasonably high.

TABLE 9

RELIABILITY OF ATTITUDE TESTS

Test	Alpha Coefficient	
	Grade Four	Grade Seven
Attitude Toward School	.90	.91
Attitude Toward Self	.79	.83

The intercorrelations of the items in each test are shown in TABLES 10, 11, 12, and 13. The correlation coefficients are Pearson Product Moment Correlations between each pair of items on each survey.

Cursory analysis of the four displays shows that lower coefficients are present for the two surveys which also had lower alpha coefficients--attitude toward self at grades four and seven. A partial explanation for the lower correlations might be the scope of the attitude toward self questions included in the survey. The questions are concerned with the individual both outside his life in school and in his role as a student. Hence, the self attitude in contrast to the school attitude is broader in scope and may require a considerably larger sampling of the item domain to produce a high reliability.

Factor Groupings

The original selection of items for the attitude surveys was done on the basis of face validity. Interitem correlations were computed to ascertain the relationships between the questions, and, finally, a factor analysis was done. (The latter analysis technique is useful in revealing how many separate groupings of items or "factors" are being measured.) Final selection of items was then made on the basis of which items seemed to be similar.

Identical analyses were conducted on the 1973-74 assessment data to determine whether or not the attitude survey really did measure two factors or traits as hypothesized. The correlation matrices have already been shown in TABLES 10, 11, 12, and 13, and the results of the factor analysis are shown in TABLES 14 and 15.

TABLE 10

ITEM CORRELATIONS FOR STATEMENTS ABOUT SCHOOL, GRADE FOUR[a]

	Item Number														
	1	3	5	7	8	10	12	15	16	19	21	24	27	29	30
1															
3	.23														
5	.25	.24													
7	(.24)	(.33)	(.30)												
8	.21	.20	.24	(.30)											
10	.23	.38	.26	(.33)	.25										
12	.31	.41	.28	(.41)	.35	.43									
15	.29	.40	.27	(.34)	.28	.43	.57								
16	.30	.37	.27	(.38)	.28	.40	.56	.50							
19	(.20)	(.35)	(.20)	.40	(.27)	(.40)	(.43)	(.42)	(.40)						
21	.30	.45	.30	(.42)	.32	.48	.69	.63	.61	(.50)					
24	.32	.45	.30	(.43)	.34	.48	.68	.64	.59	(.52)	.77				
27	(.25)	(.43)	(.27)	.45	(.31)	(.49)	(.56)	(.54)	(.52)	.57	(.65)	(.69)			
29	(.29)	(.25)	(.19)	.32	(.26)	(.29)	(.38)	(.37)	(.33)	.36	(.40)	(.42)	.43		
30	.24	.31	.28	(.42)	.27	.36	.47	.42	.45	(.40)	.52	.55	(.50)	(.36)	

[a]Negative coefficients (contained in parentheses) have been reflected; these coefficients were expected to be negative due to the fact that the desired response for items 7, 19, 27, and 29 is "False" while the desired response for the remaining eleven items is "True."

TABLE 11

ITEM CORRELATIONS FOR STATEMENTS ABOUT SELF, GRADE FOUR[a]

Item Number	2	4	6	9	11	13	14	17	18	20	22	23	25	26	28
2															
4	.18														
6	.20	.22													
9	.17	.24	.21												
11	.13	.19	.17	.18											
13	.13	.14	.18	.17	.05										
14	.21	.41	.23	.36	.23	.18									
17	.13	.13	.10	.17	.13	.16	.17								
18	(.11)	(.27)	(.28)	(.18)	(.17)	(.12)	(.31)	(.08)							
20	.23	.22	.22	.23	.14	.19	(.28)	.17	(.20)						
22	(.12)	(.25)	(.18)	(.21)	(.10)	(.15)	(.36)	(.06)	.33	(.20)					
23	.22	.18	.18	.28	.11	.25	.32	.18	(.16)	.29	(.20)				
25	(.10)	(.19)	(.18)	(.16)	(.11)	(.12)	(.30)	(.03)	.29	(.18)	.39	(.19)			
26	.21	.21	.21	.25	.17	.18	.30	.20	(.18)	.45	(.22)	.29	(.18)		
28	(.12)	(.21)	(.13)	(.15)	(.05)	(.12)	(.27)	(.04)	.25	(.16)	.36	(.18)	.30	(.17)	

[a]Negative coefficients (contained in parentheses) have been reflected; these coefficients were expected to be negative due to the fact that the desired response for these four items (18, 22, 25, and 28) is "True," while the desired response for the remaining eleven items is "False."

TABLE 12

ITEM CORRELATIONS FOR STATEMENTS ABOUT SCHOOL, GRADE SEVEN[a]

Item Number	Item Number														
	1	3	5	7	8	10	12	15	16	19	21	24	27	29	30
1															
3	.23														
5	.29	.22													
7	(.32)	(.41)	(.35)												
8	.33	.22	.24	(.28)											
10	.24	.43	.26	(.40)	.23										
12	.37	.43	.30	(.40)	.40	.38									
15	.33	.40	.27	(.31)	.33	.36	.51								
16	.36	.42	.32	(.40)	.36	.40	.57	.45							
19	(.24)	(.36)	(.22)	.40	(.25)	(.33)	(.36)	(.32)	(.37)						
21	.36	.48	.32	(.40)	.35	.43	.72	.54	.63	(.41)					
24	.38	.52	.33	(.47)	.39	.46	.68	.54	.63	(.44)	.73				
27	(.30)	(.53)	(.31)	.50	(.29)	(.51)	(.51)	(.46)	(.50)	.48	(.57)	(.64)			
29	(.43)	(.31)	(.27)	.35	(.32)	(.28)	(.43)	(.43)	(.38)	.34	(.43)	(.46)	.43		
30	.34	.41	.34	(.51)	.30	.41	.47	.39	.48	(.40)	.50	.57	(.54)	(.40)	

[a]Negative coefficients (contained in parentheses) have been reflected; these coefficients were expected to be negative due to the fact that the desired response for these four items (7, 19, 27, and 29) is "False" while the desired response for the remaining eleven items is "True."

TABLE 13

ITEM CORRELATIONS FOR STATEMENTS ABOUT SELF, GRADE SEVEN[a]

Item Number	Item Number														
	2	4	6	9	11	13	14	17	18	20	22	23	25	26	28
2															
4	.21														
6	.21	.29													
9	.16	.36	.23												
11	.20	.22	.22	.16											
13	.15	.22	.20	.23	.13										
14	.19	.52	.28	.40	.22	.25									
17	.21	.18	.14	.16	.18	.17	.19								
18	(.20)	(.44)	(.37)	(.27)	(.22)	(.19)	(.42)	(.18)							
20	.28	.29	.25	.23	.20	.21	.30	.22	(.27)						
22	(.14)	(.32)	(.20)	(.25)	(.12)	(.16)	(.44)	(.09)	.37	(.24)					
23	.18	.23	.16	.27	.11	.27	.29	.16	(.19)	.19	(.21)				
25	(.13)	(.35)	(.27)	(.25)	(.15)	(.18)	(.41)	(.11)	.40	(.22)	.40	(.20)			
26	.24	.29	.26	.25	.21	.21	.32	.23	(.26)	.53	(.22)	.23	(.21)		
28	(.12)	(.32)	(.20)	(.27)	(.11)	(.20)	(.42)	(.11)	.33	(.21)	.45	(.24)	.41	(.23)	

[a]Negative coefficients (contained in parentheses) have been reflected; these coefficients were expected to be negative due to the fact that the desired response for these four items (18, 22, 25, and 28) is "True," while the desired response for the remaining eleven items is "False."

TABLE 14

FACTOR ANALYSIS OF THE ATTITUDE QUESTIONNAIRE: ATTITUDE TOWARD SCHOOL

Question Number	Factor 1 (School)		Factor 2 (Self)	
	Grade 4	Grade 7	Grade 4	Grade 7
1	.40	.49	.06	- .09
3	.54	.61	- .01	- .01
5	.40	.45	- .00	- .03
7	.56	.61	- .10	- .08
8	.43	.47	.06	- .09
10	.59	.57	- .02	- .04
12	.76	.74	- .03	- .06
15	.70	.63	- .09	- .08
16	.70	.72	- .02	- .04
19	.61	.54	- .11	- .09
21	.83	.89	- .05	- .03
24	.85	.84	- .06	- .08
27	.77	.74	- .11	- .10
29	.51	.56	- .22	- .21
30	.63	.68	- .12	- .11

TABLE 15

FACTOR ANALYSIS OF THE ATTITUDE QUESTIONNAIRE: ATTITUDE TOWARD SELF

Question Number	Factor 1 (School)		Factor 2 (Self)	
	Grade 4	Grade 7	Grade 4	Grade 7
2	.04	.08	.36	.38
4	.01	- .06	.50	.63
6	- .11	- .09	.41	.63
9	- .09	- .15	.47	.49
11	.14	.10	.33	.36
13	- .21	- .11	.31	.37
14	.01	- .10	.66	.69
17	- .05	.02	.27	.32
18	- .06	- .13	.46	.60
20	- .07	- .01	.50	.53
22	- .07	- .12	.50	.53
23	- .16	- .14	.47	.40
25	- .07	- .24	.43	.52
26	- .04	- .01	.51	.53
28	- .11	- .19	.40	.51

In TABLE 14, the factor loadings for the items measuring attitude toward school are all above 0.40, while those of attitude toward self are nearly zero. The reverse is true in TABLE 15. This is evidence that the two sets of items are measuring two separate psychological traits.

SUMMARY

The 1973-74 Michigan Educational Assessment Program (MEAP) provided information on twenty-two separate measures of interest to educators. While some of the data were gathered in routine Michigan Department of Education reports, student performance data were gathered using the Michigan Educational Assessment Program tests during September and October of 1973.

The 1973-74 program provides for measures of (1) word relationships, (2) mathematics, (3) reading and (4) attitudes (optional). In contrast to past educational assessment programs, the mathematics and reading instruments are objective-referenced tests. Each test contains items that measure a set of minimal performance objectives.

Committees of Michigan educators assisted in the development and review of both the objectives and the items. Because of the representativeness of the content domain, the tests, in general, can be judged to have good content validity. However, there are individual cases of unclear objectives or test items which need to be improved.

The reading and mathematics tests in their entirety are reliable tests for group decision-making. However, for certain objectives, the measured reliability of the five associated test items is such that caution should be used before making decisions about an individual's attainment of a particular objective.

A majority of the objectives were mastered by between 50 and 90 percent of the students. In general, students who scored higher on the word relationships test did better on the objective-referenced tests. Last, the attitude surveys utilized in the assessment program appear to be reliable measures of two separate factors.

APPENDIX A

DEFINITIONS OF MEASURES UTILIZED IN THE MICHIGAN EDUCATIONAL ASSESSMENT PROGRAM

DEFINITIONS OF THE EDUCATIONAL ASSESSMENT MEASURES

Human Resources

1. **Professional instructional staff per 1,000 pupils.** The information to compute this measure was taken from the 1972 "Fourth Friday Report". The total number of professional instructional staff was obtained by adding the number of elementary and secondary staff (expressed as full-time equivalency) in the following categories: principals, assistant principals, other administrators (excluding districtwide administrative staff), consultants and supervisors, classroom teachers, librarians, audio-visual staff, guidance personnel and school counselors, psychological staff, radio and television instructional staff, teachers of the homebound, and other instructional staff. The total number of pupils was obtained by counting all pupils enrolled in grades one through twelve except special education pupils. Pupils who attended the school for a portion of the day and attended a non-public school for the remainder of the day were included on a full-time equivalency basis. For example, a pupil who attended the school for one-fourth of each day and attended a non-public school for the other three-fourths of each day was counted as one-fourth pupil. In order to obtain the number of professional instructional staff per 1,000 pupils, the total number of professional instructional staff was multiplied by 1,000 and divided by the total number of pupils.

2. **Teachers per 1,000 pupils.** The information to compute this measure was taken from the 1972 "Fourth Friday Report". The total number of teachers was obtained by adding the number of elementary and secondary classroom teachers. Kindergarten teachers, special education teachers, and non-classroom teachers were not included in the total. The total number of pupils was obtained by counting all pupils enrolled in grades one through twelve except special education pupils. Pupils who attended the school for a portion of the day and attended a non-public school for the remainder of the day were included on a full-time equivalency basis. In order to obtain the number of teachers per 1,000 pupils, the total number of teachers was multiplied by 1,000 and divided by the total number of pupils.

3. **Average years' teaching experience.** The information to compute this measure was taken from the 1972 "Fourth Friday Report". The average was obtained by dividing the total years of teaching experience of full-time classroom teachers who work only in a school by the number of such teachers in that school. District level averages were obtained by adding the total years of experience for all schools in the district and dividing by the sum of the full-time classroom teachers in all schools in the district.

4. **Percent of teachers with master's degree.** The information to compute this measure was taken from the 1972 "Fourth Friday Report". It was obtained by dividing the number of full-time classroom teachers who had completed all of the requirements for a master's degree by the total number of full-time classroom teachers. The resultant value was multiplied by 100 to convert to a percent figure.

5. **Average contracted salary of teachers.** The information necessary to compute this measure was taken from the 1972 "Fourth Friday Report". It was obtained by dividing the total annual contractual salaries paid to full-time classroom teachers who work only in a school by the number of such teachers in that school. District level averages were obtained by adding the total annual contractual salaries for all schools in the district and dividing by the sum of full-time classroom teachers in all schools in the district.

The average salary of teachers in 1971—72 did not include supplemental payments such as payments for coaching, summer school, department head bonus, etc. The salary figures reported for 1972—73 include such payments insofar as such payments were part of the contractual agreement between teacher and school district.

School District Financial Resources

6. **State-equalized valuation per resident member (1970—71).** The information to compute this measure was taken from records filed with the Michigan Department of Education. The total state-equalized valuation (SEV) is equal to approximately 50 percent of the fair cash value of the real and personal property in the district. It is calculated as of May 26, 1971 (the fourth Monday in May) and applied to the 1971—72 academic year. In order to obtain a per-pupil value for SEV, the total SEV was divided by resident membership for the 1971—72 academic year. Resident membership, obtained from the 1971—72 "Fourth Friday Report," includes all pupils residing in the district who attended public school in that district or in any other district; resident membership excludes pupils who attended school in the district but resided in another district, as well as excluding pupils who attended private or parochial schools.

7. **Local revenue per pupil 1971—72.** The information to compute this measure was taken from records provided by the local districts and filed with the Michigan Department of Education. The financial information was reported in the Annual School District Financial Report for the fiscal year which ended June 30, 1972. The total value for local revenue included revenue from sources such as the following: property tax (the major source of local revenue), local government appropriations, tuition, transportation fees, revolving funds (i.e., revenue from food services, book stores, and student body activities), rent from school facilities, etc. Tuition from community college patrons was not included in the calculation. In order to obtain local revenue per pupil, total local revenue was divided by the state aid membership (the total number of pupils enrolled in the district as of October 1, 1971, the fourth Friday after Labor Day).

8. **State school aid per pupil 1971—72.** The information to compute this measure was taken from records provided by the local districts and filed with the Michigan Department of Education. The financial data were taken from the Annual School District Financial Report for the fiscal year which ended June 30, 1972. The value for total state school aid represented the direct appropriations from the state, including appropriations for state school aid, driver education, underprivileged children, and other state grants. In order to compute the state school aid per pupil, the total state school aid was divided by 1971—72 state aid membership.

9. **K-12 instructional expense per pupil 1971—72.** The information to compute this measure was taken from records provided by the local districts and filed with the Michigan Department of Education. The financial information was reported in the Annual School Financial Report for the fiscal year which ended June 30, 1972. The total K-12 instructional expense included expenditures for salaries and supplies connected with elementary education, secondary education, special education, summer school, and adult education. Expenditures associated with community colleges were omitted from the calculation. In order to obtain a value for instructional expense per pupil, total K-12 instructional expense was divided by the 1971--72 state aid membership.

10. **Elementary instructional expense per pupil 1971—72.** The information to compute this measure was taken from financial reports provided by the local districts and filed with the Michigan Department of Education. Financial information was reported in the Annual School District Financial Report for the fiscal year which ended June 30, 1972. The elementary instructional expense included expenditures for salaries and supplies connected with elementary education. In order to obtain a value for elementary instructional expense per pupil for districts organized to operate a high school, total elementary instructional expense was divided by the elementary state aid membership, taken from the 1971—72 "Fourth Friday Report". For districts not organized to operate a high school (i.e., those that operate no grade above grade 8) total elementary instructional expense was divided by the K-8 state aid membership. Prekindergarten and special education pupils were not included.

11. **Total current operating expense per pupil (1971—72).** The information to compute this measure was taken from records provided by the local districts and filed with the Michigan Department of Education. The financial information was reported in the Annual School District Financial Report for the fiscal year which ended June 30, 1972. The total current operating expense included expenses connected

with adminstration, attendance, health services, pupil transportation, plant operation, plant maintenance, and fixed charges in addition to instructional expenses (including elementary, secondary, special education, summer school, and adult education instructional expenses). Community college expenses were not included in the computation of total operating expense. The value for total current operating expense was divided by the 1971—72 state aid membership.

12. **Total operating millage (1971—72).** The information to compute this measure was taken from records provided by intermediate districts and filed with the Michigan Department of Education. Millage information was reported on the form "1971—72 Tax Levies of School Districts Based on 1971 State Equalized Valuation" submitted to the Department in November of 1971 for the 1971—72 school year. Total operating millage is the tax rate in mills applied to the state-equalized valuation of a district to produce revenue for the operation of its schools (not including building and site or debt retirement millage).

Percent Minority

13. **Percent of racial-ethnic minority students.** Percent of racial-ethnic minority students was computed for each school in the state. The information to compute this measure was taken from the 1972 "Fourth Friday Report". The total number of racial-ethnic minority students included all racial-ethnic minority students in the school. Pre-kindergarten students, kindergarten students, special education students, and part-time students were all included in the total. Since the information was expressed in terms of a head count, part-time students were not counted differently from full-time students. Students were classified as belonging to a racial-ethnic minority group if they were considered by the school to be of that group. Pre-kindergarten students, kindergarten students, special education students, and part-time students were included in the total. In order to calculate the percent of racial-ethnic minority students, the total number of racial-ethnic minority students was divided by the total number of students and the resultant figure was multiplied by 100.

Dropout Rate (1971—72)

14. **School dropout rate.** School dropout rate was computed from information taken from records provided by the local districts and filed with the Michigan Department of Education. The measure was based on figures from the local districts' School Dropout Report and enrollment of students in grades 9-12 during the 1971—72 academic year. Included as dropouts were students who left school for any of the following reasons: married, sent to corrective institutions, accepted employment, or dropped from attendance roll because absent 10-30 days. Not included as dropouts were students who left the district because they transferred to another district, were sent to institutions for defectives, or became sick or died. The dropout rate is calculated by dividing the number of dropouts by the sum of the number of students enrolled in grades 9-12 on the "Fourth Friday" plus new students enrolled during the year, computed from the 1971—72 School Dropout Report. The resultant figure was multiplied by 100.

Achievement

15. **Word Relationships.** The fourth grade Word Relationships test contained 45 verbal analogy problems which were designed to measure students' knowledge of the meaning of words and the relationships between words and concepts. Twenty minutes were allowed to work on the test. The seventh grade test contained 38 questions of the same type. The time allowed to work on this test was 15 minutes.

16. **Reading.** The reading tests are described in Section I of this report.

17. **Mathematics.** The mathematics tests are described in Section I of this report.

Size Measures

18. **Grade 4 membership.** Grade 4 membership was obtained by counting all full-time pupils enrolled in grade 4 except special education pupils.

19. **Grade 7 membership.** Grade 7 membership was obtained by counting all full-time pupils enrolled in grade 7 except special education pupils.

20. **Total membership.** Total membership was obtained by counting all full-time pupils in all grades operated by the district from kindergarten through the 12th grade, except special education pupils.

Attitude Measures

A pupil attitude questionnaire was offered for local district use on an optional basis. In districts that elected to use the questionnaire it was administered by reading the items aloud while pupils read them silently, recording their answers on the questionnaire itself. The results of this anonymous questionnaire were reported in the form of summaries aggregated at the classroom, school, and district level.

21. **Attitude toward self** was obtained by counting the favorable responses to the 15 questionnaire items toward self and subtracting the unfavorable responses. "I'm not sure" responses and omits were not counted. The resulting scores were converted to a five-point scale extending from 1 (very unfavorable) to 5 (very favorable).

22. **Attitude toward school** was obtained by counting the favorable responses to the 15 questionnaire items that reflect attitude toward school and subtracting the unfavorable responses. "I'm not sure" responses and omits were not counted. The resulting scores were also converted to a five-point scale extending from 1 (very unfavorable) to 5 (very favorable).

APPENDIX B

LIST OF OBJECTIVES MEASURED

BY THE 1973-74 TESTS

MATHEMATICS OBJECTIVES
MEASURED IN THE 1973—74
MICHIGAN EDUCATIONAL ASSESSMENT PROGRAM*
Grade 4

No.	Code**	Objective
1.	AR-I-A-6	Given a set of objects, the learner will recognize objects that are the same size.
2.	AR-I-A-8	Given an object shaped like a circle, triangle, square, or rectangle, the learner will choose the shape the object represents.
3.	AR-I-A-16	Given a set of three containers, one full, one empty, and one half-filled, the learner will choose the containers that are arranged from full to empty.
4.	AR-I-A-24	Given a collection of five objects of varying lengths, the learner will identify the longest or the shortest, as requested.
5.	AR-I-A-39	Given five small toys in a line, the learner will identify the first toy and the last one.
6.	AR-I-B-7	Given a set with less than ten objects, the learner will identify an equivalent set.
7.	AR-I-B-32	Given a set of two to eight objects, the learner will identify a set having fewer members than the original set.
8.	AR-I-B-40	Given a line marked with congruent segments and a set of number cards (0—10), the learner will choose the appropriate number card for the point on the line.
9.	AR-I-B-43	Given any three numbers, 0—10, the learner will identify which number is the greatest and which is the least, on request.
10.	AR-I-B-44	Given two consecutive even or odd numbers, 0—9, the learner will name the number that comes between the two given numbers.
11.	AR-I-B-45	Given a number from 1 to 8, the learner will identify the number that comes before or after the given number.
12.	AR-I-64	Given a set of tens and ones representing a number less than 100, the learner will identify the numeral.
13.	AR-I-B-65	Given a set of sequentially ordered whole numbers within a decade less than 100, such as 31, 32, . . . 40, the learner will identify the number that comes immediately before or after a given number, as requested.
14.	AR-I-B-67	Given 2 two-digit numbers, the learner will tell which number is greater and which number is less.

* This list represents all of the objectives that will be assessed in the 1973—74 Program. Other important objectives not assessed are available in the Minimal Performance Objectives for Mathematics in Michigan, Michigan Department of Education, 1973. The objectives listed here were used in the development of the assessment measures. Because of the group-administered nature of these measures, minor wording changes were made in the objectives. Educators should refer to the complete set of objectives for the original wording of these objectives.

** Code number reference used in the full list of performance objectives named in the above footnote.

15. AR-I-B-70 Given a set of dimes and pennies valued between 11 and 99 cents (one dime, one penny to nine dimes, nine pennies), the learner will state the value.

16. AR-I-B-79 Given any three-digit number, the learner will write expanded notation to 1,000, first by using place value words and then by using numerals.

17. AR-I-B-81 Given a random list of two- and three-digit numbers, the learner will identify the list that is in ascending order.

18. AR-I-B-82 Given 2 three-digit numbers which have the same digits but in different positions, the learner will compare them to determine which is greater and which is less.

19. AR-I-B-84 Given a counting sequence of two or four numbers, the learner will write the next number in the sequence.

20. AR-I-B-85 Given the counting numbers 1—10, the learner will indicate those that are multiples of 2.

21. AR-I-B-86 Given a set of objects, the learner will select another set that will have twice as many objects.

22. AR-II-A-10 Given addition exercises involving a two-digit number plus a one-digit number requiring no regrouping (carrying), the learner will find the sums with or without the use of aids.

23. AR-II-B-6 Given a word problem read by the teacher, involving addition or subtraction combinations to 10, the learner will identify the operation and the sum or difference.

24. AR-II-B-9 Given a set of objects or pictures showing a subtraction relationship with combinations to 18, the learner will identify an appropriate number sentence.

25. AR-II-B-11 Given a subtraction word problem read by the teacher involving combinations to 18, the learner will: (1) identify the operation, (2) identify an appropriate number sentence, and (3) identify the answer.

26. AR-II-B-13 Given two sets of objects, one with more objects than the other, the learner will identify how many more members it has.

27. AR-II-B-15 Given a two-digit number, the learner will subtract one-digit numbers with no regrouping (borrowing) with or without the use of aids.

28. AR-II-B-16 Given a two-digit number, the learner will subtract a two-digit number with no regrouping (borrowing).

29. AR-III-D-1 Given groups of less than 13 objects and a statement (½ of___, ¼ of__), the learner will identify the group that shows the appropriate fractional part of the whole.

30. M-I-A-5 Given rulers specially scaled in inches and half-inches, the learner will identify the measurement of objects to the nearest inch.

31. M-II-A-6 Given the reading "_____ o'clock" and a clock face, the learner will identify the clock showing the appropriate time.

32. M-II-B-3 Given three to five different amounts of money, all less than or equal to $5.00, the learner will identify the greatest or the least.

33. M-II-C-1 Given a Fahrenheit or Centigrade thermometer, the learner will identify the temperature (above zero) to the nearest degree.

34. G-I-A-2 Given pictures of various shapes, the learner will identify circles, triangles, squares, and rectangles as requested.

35. AL-1 Given a statement of equality involving addition or subtraction facts and a placeholder for the sum or difference, the learner will supply the sum or difference.

MATHEMATICS OBJECTIVES
MEASURED IN THE 1973—74
MICHIGAN EDUCATIONAL ASSESSMENT PROGRAM
Grade 7

No.	Code	Objective
1.	AR-I-B-87	Given any four-digit number, the learner will identify the number that is 100 or 1000 more or less than it is, without using formal addition or subtraction.
2.	AR-I-B-89	Given a number orally, the learner will identify the arabic numeral.
3.	AR-II-A-22	Given addition exercises involving a three-digit number plus a one-, two-, or three-digit addend, with or without regrouping (carrying), the learner will identify the sums, using any technique.
4.	AR-II-A-26	Given addition problems involving two or three addends with three, four, five, or six digits, with or without regrouping, the learner will find the sums, using any techniques.
5.	AR-II-B-20	Given a three-digit number, the learner will subtract a two- or three-digit number, with or without the use of aids.
6.	AR-II-C-6	Given a repeated addition sentence, the learner will represent it as a multiplication sentence with its product.
7.	AR-II-C-11	Given two numbers, the learner will demonstrate that the order in which they are multiplied does not change the product.
8.	AR-II-C-13	Given a one-digit number (10, 20 . . .), (100, 200 . . .), the learner will state the product.
9.	AR-II-C-15	Given a two-digit number to be multiplied by a one-digit number, the learner will identify the product, with or without aids.
10.	AR-II-D-5	Given a sentence with one single digit, a missing factor, and a product (whole numbers), the learner will identify the missing factor.
11.	AR-II-D-7	Given a division fact, the learner will identify it rewritten as a multiplication fact.
12.	AR-II-D-9	Given a one-digit divisor (factor) and a dividend (product) of less than 100, the learner will identify the quotient (missing factor) if there is no remainder.
13.	AR-II-D-15	Given an exercise with a dividend of four digits or less, and a one-digit divisor, the learner will identify the quotient.
14.	AR-III-A-1	Given several objects, some divided into congruent parts, some divided into noncongruent parts, the learner will identify congruent parts.
15.	AR-III-A-18	Given a diagram divided into congruent parts, with some parts shaded, the learner will identify the shaded area by identifying an appropriate fraction.
16.	AR-III-A-19	Given any five fractions with like denominators, in random order, the learner will identify them in order (halves, thirds, fourths, fifths, sixths, eighths, tenths); with or without the use of aids.

17. AR-III-B-4 Given two common fractions with like denominators and a sum greater than 1, the learner will identify the sum, with or without the use of fractional cut-out parts.

18. AR-III-B-7 Given two mixed numbers with like denominators, the learner will write the sum.

19. AR-III-C-4 Given a mixed number and a fraction with like denominators of 2, 3, 4, 6, or 8, where no regrouping is necessary, the learner will find the difference.

20. AR-III-C-6 Given a whole number and a common fraction with a denominator of 2, 3, 4, 6, or 8, the learner will find the difference with or without the use of fractional parts.

21. AR-III-D-4 Given two unit fractions with denominators less than seven, the learner will compute the product with or without the use of a model.

22. AR-IV-A-3 Given a model of a fraction illustrating hundredths, the learner will identify the decimal fraction as illustrated.

23. AR-IV-A-7 Given a decimal fraction of no more than three places, the learner will name the place value of each digit, without aids.

24. AR-IV-B-3 Given a verbal problem involving addition and subtraction of decimal numbers involving only tenths, the learner will find the answer.

25. AR-IV-B-6 Given a verbal problem involving addition and subtraction of decimal numbers involving tenths and hundredths, the learner will find the answer.

26. AR-IV-B-9 Given an addition and subtraction decimal problem in horizontal or vertical form with no more than five (5) digits and no more than three (3) decimal places, the learner will find the sum or difference.

27. AR-VI-15 Given a picture of sets paired in (A) a one-to-one, (B) a many-to-one, or (C) a one-to-many ratio and part of another pair, the learner will identify the pair that keeps the ratio equivalent.

28. M-I-A-10 Given rulers specially scaled in quarter inches or eighth inches, the learner will measure objects to the nearest quarter unit.

29. M-I-B-8 Given a polygon, the learner will estimate its area in square units.

30. M-I-C-7 Given a drawing of a rectangular solid divided into units (dimension less than or equal to 5 units), the learner will name the number of units in it.

31. M-II-A-10 Given a clock face with hands on it, the learner will choose the correct time notation.

32. M-II-A-11 The learner will use A.M. and P.M. notation in writing time.

33. M-II-B-7 Given two money values, the learner will add or subtract, using dollars and cents notation.

34. M-II-B-8 Given two money values, the learner will choose the approximate sum or difference to the nearest dollar or ten cents.

35. M-II-B-9 Given verbal problems consisting of one or two operations involving money values less than or equal to $20, the learner will solve the problems.

36. M-II-C-3 Given a Fahrenheit or Centigrade thermometer, the learner will identify temperatures to the nearest degree, using the degree [°] symbol.

37. G-I-A-4 Given a set of quadrilaterals, the learner will identify and name a parallelogram, a square, and a rectangle.

38. G-I-B-3 Given models of lines or line segments, some of which are parallel, intersecting, and perpendicular, the learner will identify and name each.

39. G-I-B-5 Given the description of a plane, and a part of a plane, the learner will identify surfaces which represent a plane or part of a plane.

40. AL-2 Given a statement of equality involving addition, subtraction, or multiplication facts and containing a placeholder or letter, the learner will identify the missing number.

41. AL-4 Given a pair of whole numbers or number phrases less than 1,000, the learner will identify the appropriate symbol of equality or inequality, < or = or >.

42. AL-5 Given an equation involving one or zero, the learner will complete the sentence.

43. AL-7 Given a numerical statement involving the distributive property and a placeholder, the learner will insert the missing value.

44. AL-10 Given a verbal exercise involving a number in a single operation, the learner will write a related algebraic expression.

45. P-9 Given a coordinate system using whole numbers and/or letters and given 3 pairs of coordinates, the learner will locate the points.

READING OBJECTIVES
MEASURED IN THE 1973—74
MICHIGAN EDUCATIONAL ASSESSMENT PROGRAM*
Grade 4

No.	Code	Objective
1.	2.1	Given a reading selection at the third grade level, the learner will match a series of words in the selection with appropriate definitions.
2.	2.2	Given a set of phrases, the student will indicate those phrases which have the same meaning.
3.	3.1	Given a reading selection at the third grade level, the learner will answer multiple-choice questions with words and/or phrases extracted from that selection.
4.	3.2	Given a reading selection at the third grade level in which every fifth word has been replaced with a blank, the learner will choose the exact word appropriate to the blank space at 50% accuracy.
5.	4.1	Given a method of arranging data, the learner will identify the method (e.g., color, size, importance, time, etc.).
6.	4.4	Given a series of randomly placed words, the student will be able to alphabetize the words through the first three letters.
7.	5.1	Given a series of reading selections, the learner will indicate those which are factual.
8.	5.2	Given a series of reading selections, the learner will indicate those which are fictional.
9.	6.1-6.3	Given a reading selection, the learner will be able to identify the author's purpose (e.g., persuasion, entertainment, propaganda, etc.).
10.	7.1	Given a reading selection at the third grade level, the learner will select from a list of possible titles the one most appropriate as the title for that selection.
11.	7.2	Given a reading selection at the third grade level, the learner will select from a series of still pictures the one picture most appropriate in depicting the main idea of the selection.
12.	7.3	Given a reading selection at the third grade level, the learner will select from a number of short summaries the one which best summarizes the selection.
13.	8.4	Given a reading selection at the third grade level, the learner will match a series of direct quotations from the story with the character who is speaking.
14.	9.3	Given a reading selection at the third grade level, the learner will correctly answer a series of multiple choice questions relating to the sequence of events or ideas presented in the selection.

* This list represents all of the reading objectives that will be assessed in the 1973-74 program. Other important objectives not covered in these tests are available in the list of Communication Skills Performance Objectives available from the Michigan Department of Education.

15. 10.2 Given three or more selections at the third grade level, the learner will choose the two most alike in the mood expressed.

16. 10.3 Given a reading selection at the third grade level, the learner will choose from a series of sentences that sentence which best describes how a given character feels in a story.

17. 10.6 Given a selection containing figurative language, the learner will identify the definition of that phrase.

18. 11.1 Given a reading selection at the third grade level, the learner will correctly match a series of causes with a corresponding series of effects.

19. 11.2 Given a reading selection at the third grade level with the conclusion of the story deleted, the learner will select from a series of possible conclusions the one most appropriate to the selection.

20. 13.1 Given a locational question, the learner will choose from a series of reference sources where that item will be found.

21. 13.2 Given a locational question about newspapers, the learner will select the section where he would find the answer.

22. 14.1-14.3 Given a reading selection at the third grade level, the learner will answer correctly a series of multiple-choice questions relating to meanings, generalizations, or conclusions not expressed in the selection itself.

23. * Given a reading selection at the third grade level, the learner will correctly answer a series of multiple-choice questions relating to motivation.

* This objective was omitted from the reading performance objectives after the deadline established for test development.

READING OBJECTIVES
MEASURED IN THE 1973—74
MICHIGAN EDUCATIONAL ASSESSMENT PROGRAM
Grade 7

No.	Code	Objective
1.	18.1	Given a reading selection at the sixth grade level, the learner will match a series of words in the selections with appropriate definitions.
2.	18.2	Given a set of phrases, the student will indicate those phrases which have the same meaning.
3.	19.1	Given a reading selection at the sixth grade level in which every fifth word has been replaced with a blank, the learner will choose the exact word appropriate to the blank space at 50% accuracy.
4.	19.2	Given a reading selection at the sixth grade level, the learner will answer multiple choice questions with words and/or phrases extracted from that selection.
5.	20.1	Given a method of arranging data, the learner will identify the method (e.g., color, size, importance, time, etc.).
6.	21.1	Given a series of randomly placed words, the student will be able to alphabetize the words through the first three letters.
7.	22.1	Given a series of reading selections, the learner will indicate those which are factual.
8.	22.2	Given a series of reading selections, the learner will indicate those which are fictional.
9.	23.1-23.3	Given a reading selection, the learner will be able to identify the author's purpose (e.g., persuasion, entertainment, propaganda, etc.).
10.	24.1	Given a reading selection at the sixth grade level, the learner will select from a list of possible titles the one most appropriate as the title for that selection.
11.	24.2	Given a reading selection at the sixth grade level, the learner will select from a series of still pictures the one picture most appropriate in depicting the main idea of the selection.
12.	24.3	Given a reading selection at the sixth grade level, the learner will select from a number of short summaries the one which best summarizes the selection.
13.	24.4	Given a series of three or more reading selections at the sixth grade level, the learner will choose the two most alike in the ideas expressed.
14.	25.3	Given a reading selection at the sixth grade level, the learner will match a series of direct quotations from the story with the character who is speaking.
15.	26.3	Given a reading selection at the sixth grade level, the learner will correctly answer a series of multiple choice questions relating to the sequence of events or ideas presented in the selection.
16.	27.2	Given a reading selection at the sixth grade level, the learner will choose from a series of sentences that sentence which best describes how a given character feels in a story.

17. 28.1 Given a reading selection at the sixth grade level, the learner will correctly answer a series of multiple choice questions relating to motivation.

18. 29.1 Given a reading selection at the sixth grade level, the learner will correctly match a series of causes with a corresponding series of effects.

19. 29.5 Given a reading selection at the sixth grade level, the learner will answer correctly a series of multiple choice questions relating to meanings, generalizations, or conclusions not expressed in the selection itself.

20. 30.2 Given three or more selections at the sixth grade level, the learner will choose the two most alike in the mood expressed.

21. 31.1 Given a locational question, the learner will choose from a series of reference sources where that item will be found.

22. 31.2 Given a locational question about newspapers, the learner will select the section where he would find the answer.

23. 32.1 Given a reading selection at the sixth grade level with the conclusion of the story deleted, the learner will select from a series of possible conclusions the one most appropriate to the selection.

APPENDIX C

PUPIL NORMS FOR THE 1973-74

WORD RELATIONSHIPS TEST

Table of Word Relationships Scores
Comparing January, 1973 norms with October, 1973 norms*

Raw Score	Grade 4			Grade 7		
	Equated Standard Score	Percent Below		Equated Standard Score	Percent Below	
		January, 1973	October, 1973		January, 1973	October, 1973
45	72	99+	99+			
44	71	99	99			
43	70	98	99			
42	69	97	98			
41	67	95	96			
40	66	93	95			
39	65	91	93			
38	64	88	91	72	99+	99+
37	63	85	89	71	99+	99+
36	61	83	86	69	99	99
35	60	80	84	68	98	99
34	59	77	81	66	96	97
33	58	74	79	65	94	95
32	57	71	76	64	91	92
31	55	68	74	62	88	89
30	54	65	71	61	84	85
29	53	62	68	59	79	81
28	52	58	65	58	75	76
27	51	55	62	56	70	71
26	49	51	59	55	65	67
25	48	47	56	53	61	62
24	47	44	52	52	56	57
23	46	40	48	50	51	51
22	45	37	44	49	46	47
21	43	33	40	47	42	41
20	42	29	36	46	37	37
19	41	26	32	44	33	32
18	40	23	28	43	29	28
17	38	20	24	41	25	24
16	37	17	21	40	21	20
15	36	14	17	38	17	16
14	35	11	15	37	13	13
13	34	9	12	36	10	10
12	32	7	10	34	7	7
11	31	5	8	33	5	5
10	30	3	6	31	3	3
9	29	2	4	30	2	2
8	28	1	3	28	1	1
7	26	1	2	27	1	1
6	25	1-	1	25	1-	1-
5	24	1-	1	24	1-	1-
4	23	1-	1	22	1-	1-
3	22	1-	1-	21	1-	1-
2	20	1-	1-	19	1-	1-
1	19	1-	1-	18	1-	1-
0	18	1-	1-	16	1-	1-

* January, 1973 norms were based upon 157,854 fourth, and 160,200 seventh graders tested in January, 1973. October, 1973 norms were based upon representative samples of 4977 fourth, and 4991 seventh graders.